

Vol. 2.

NOVEMBER, 1915

No. 9.

JOURNAL
OF THE
BOSTON SOCIETY
OF
CIVIL ENGINEERS



Published monthly, excepting July and August, by the Society,
715 Tremont Temple, Boston, Massachusetts.

Entered as second-class matter, January 15, 1914, at the Post Office at Boston, Mass.,
under Act of August 24, 1912.

Subscription Price, \$4.00 a year (Ten Numbers)
50 Cents a Copy

Copyright, 1915, by the Boston Society of Civil Engineers.

BOSTON SOCIETY OF CIVIL ENGINEERS

OFFICERS, 1915-1916

PRESIDENT

CHARLES R. GOW

VICE-PRESIDENTS

RICHARD A. HALE

(Term expires March, 1916)

RALPH E. CURTIS

(Term expires March, 1917)

SECRETARY AND LIBRARIAN

S. EVERETT TINKHAM

TREASURER

FRANK O. WHITNEY

DIRECTORS

CHARLES M. ALLEN

(Term expires March, 1916)

LEONARD C. WASON

(Term expires March, 1916)

EDMUND M. BLAKE

(Term expires March, 1917)

GEORGE C. WHIPPLE

(Term expires March, 1917)

PAST PRESIDENTS

(Members of the Board)

JAMES W. ROLLINS

FREDERIC H. FAY

HARRISON P. EDDY

SPECIAL COMMITTEES

ON THE LIBRARY

S. EVERETT TINKHAM, Chairman

FREDERIC I. WINSLOW

HENRY F. BRYANT

ON PUBLICATION

CHARLES W. SHERMAN, Chairman

GEORGE A. CARPENTER

DeWITT C. WEBB

ON MEMBERSHIP

JOHN E. CARTY, Chairman

HUGH NAWN

GEORGE E. RUSSELL

FRANK B. SANBORN

ROBERT SPURR WESTON

Editor — EDWARD C. SHERMAN

6 Beacon Street, Boston

BOSTON SOCIETY OF CIVIL ENGINEERS

FOUNDED 1848

PROCEEDINGS

NOTICE OF REGULAR MEETING.

A REGULAR meeting of the Boston Society of Civil Engineers will be held on

WEDNESDAY, NOVEMBER 17, 1915,

at 7.45 o'clock P.M., in CHIPMAN HALL, TREMONT TEMPLE, BOSTON.

Mr. Frank C. Shepherd will present a paper on "The Federal Valuation of the Boston and Maine Railroad." The paper was printed in the October number of the JOURNAL.

S. E. TINKHAM, *Secretary*.

PAPERS IN THIS NUMBER.

"The Arrowrock Dam," C. H. Paul.
Memoir of deceased member.

Reprints from this publication, which is copyrighted, may be made provided full credit is given to the author and the Society.

Contributors are hereby notified that proof will not be submitted to them for examination unless requested before the 10th of the month preceding the month of publication.

SPECIAL NOVEMBER MEETING OF THE SANITARY SECTION.

THERE will be a special meeting of the Sanitary Section, Wednesday evening, November 24, 1915, in the Society Library, Tremont Temple, at 8 o'clock.

The speaker will be Mr. Harold I. Eaton, chief inspector of the Atlantic County Mosquito Extermination Commission. Mr. Eaton is planning to be in Boston for the holiday, which accounts for the special meeting. The subject will be,

"MOSQUITO EXTERMINATION WORK."

The talk will consist of a brief outline of the history of mosquito extermination in Cuba and Panama, the methods used and the results obtained; the history of mosquito extermination in New Jersey; with results of early studies and experiments; the species of mosquitoes troublesome in New Jersey, and their breeding places; the breeding habits of the house mosquito and the problem it affords cities and towns, and the methods used and results obtained; the salt-marsh mosquito, its breeding habits and extermination methods used; salt-marsh drainage in New Jersey and Atlantic County, and results of the work in New Jersey.

Lantern slides will be used to illustrate the work done in Panama and New Jersey.

FRANK A. MARSTON, *Clerk.*

MINUTES OF MEETING.

BOSTON, MASS., October 20, 1915.—A regular meeting of the Boston Society of Civil Engineers was held this evening at Chipman Hall, Tremont Temple, and was called to order at 8.10 o'clock by the President, Charles R. Gow. There were 148 members and visitors present.

By vote the reading of the record of the September meeting was dispensed with, and it was approved as printed in the October JOURNAL.

The Secretary reported for the Board of Government the election of the following to membership in the grades named:

Members — Edwin Whitmore Colby, Harold Bryant Barney, Raymond Franklin Bennett, Robert Charles Hunter and Frank Bates Walker.

Associate — Bertrand L. Makepeace.

Junior — James Proctor Allardice.

Mr. C. W. Sherman, speaking for the New England Water Works Association, expressed its appreciation of the courtesy which had been extended to its members in the invitation to be present at this meeting and to join in the excursion this afternoon to Salem and in the dinner at the City Club.

By vote the thanks of the Society were extended to the officials and citizens of Salem, Mass., who contributed so much to the success and pleasure of the excursion of the afternoon to inspect the new construction work of the Salem Water Supply.

The thanks of the Society were also voted to A. G. Tomasello & Son for their generous entertainment of our members at the afternoon excursion.

Mr. William S. Johnson was then introduced and read a paper, illustrated with lantern slides, entitled, "The Water Supply of Salem, Mass." At the conclusion of the reading of the paper, a discussion followed in which President Gow, Mr. Harrison P. Eddy and Mr. Robert Spurr Weston took part.

Adjourned.

S. E. TINKHAM, *Secretary*.

APPLICATIONS FOR MEMBERSHIP.

[November 5, 1915.]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a

just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

BIGELOW, LYMAN WALDO, Norwood, Mass. (Age 28, b. Norwood, Mass.) From March, 1906, to Jan., 1908, rodman, chainman and transitman with E. W. Bowditch and with L. D. Thorpe, both of Boston; from March, 1909, to Dec., 1911, with Portland Railway, Light and Power Co., Portland, Ore., as transitman, field engineer, etc.; from Sept., 1912, to Jan., 1913, assistant city engr., Oregon City, Ore.; from May to Sept., 1913, with E. Worthington, Dedham, as pipe line inspector; from Oct., 1913, to Jan., 1914, instrument man with Massachusetts Highway Comm.; from March, 1914, to Aug., 1915, instrumentman with George A. Smith, Norwood; from Aug., 1915, to date, in private practice as civil engineer and surveyor. Refers to E. M. Blake, N. L. Hammond, F. M. Hersey and D. W. Pratt.

BROWN, HORATIO WHITTEMORE, Boston, Mass. (Age 22, b. Concord, Mass.) Graduate of Mass. Inst. of Technology, 1915, architectural engineering course. Is now assistant, Dept. of Mechanical Engineering, Mass. Inst. of Technology. Refers to H. W. Hayward, W. H. Lawrence, E. F. Miller, E. F. Rockwood, C. M. Spofford and William Wheeler.

BURRILL, NATHAN CARTER, Boston, Mass. (Age 41, b. Newburyport, Mass.) Student at Mass. Inst. of Technology, 1893-97, civil engineering course. From 1897 to 1904, structural engineer and draftsman with Boston Steel & Iron Co.; from 1904 to date, engineer and estimator with H. P. Converse & Co. Refers to E. P. Bliss, M. M. Cannon, J. E. Carty, F. R. Charnock and F. W. Hodgdon.

COBURN, WILLIAM HASKINS, Lawrence, Mass. (Age 25, b. Boston, Mass.) Graduate of Mass. Inst. of Technology, 1912, civil and sanitary engineering courses. From Sept., 1912, to June, 1913, assistant, Dept. of Civil Engineering, Mass. Inst. of Technology; from Feb. to June, 1913, also assistant instructor, Dept. of Economics; from Sept., 1913, to March, 1914, industrial health inspector; from March to Dec., 1914, deputy commissioner of labor, Mass. Board of Labor and Industries; from March, 1915, to date, sanitary engineer, American Woolen Company. Refers to C. B. Breed, R. A. Hale, J. L. Howard, C. M. Spofford, R. S. Weston and R. M. Whittet.

DUGGAN, JOSEPH RICHARD, Milford, Mass. (Age 21, b. Milford, Mass.)

Senior at Mass. Inst. of Technology, sanitary engineering course. Refers to G. L. Hosmer, J. W. Howard, H. B. Luther and A. G. Robbins.

FEHR, GORDON, Boston, Mass. (Age 21, b. Burghersdorp, Cape Colony, Union of South Africa.) Student for three terms at Royal Technical College of Charlottenburg, Berlin, civil engineering course, and is now senior at Mass. Inst. of Technology, sanitary engineering course. Refers to A. E. Burton, G. L. Hosmer, J. W. Howard and H. B. Luther.

FOSTER, HOWARD LESLIE, Amesbury, Mass. (Age 21, b. Merrimac, Mass.) Senior at Mass. Inst. of Technology. Refers to C. B. Breed, J. W. Howard, Dwight Porter and G. C. Whipple.

GREEN, HOWARD WHIPPLE, Woonsocket, R. I. (Age 22, b. Woonsocket, R. I.) Graduate of Clark College, degree of A.B., 1914; is now student at Mass. Inst. of Technology, sanitary engineering course. Refers to C. B. Breed, G. L. Hosmer, J. W. Howard and G. C. Whipple.

HASTIE, FRANK BOWMAN, Passaic, N. J. (Age 20, b. Rutherford, N. J.) Senior at Mass. Inst. of Technology, sanitary and civil engineering courses. Has had some experience in both field and office work during summer vacations at Mass. Inst. of Technology Surveying Camp, and with borough engineer, Garfield, N. J. Refers to C. B. Breed, G. L. Hosmer, J. W. Howard and A. G. Robbins.

McSWEENEY, THOMAS FRANCIS, Framingham, Mass. (Age 22, b. Marlboro, Mass.) Senior at Mass. Inst. of Technology, sanitary engineering course. From Sept. to Nov., 1911, chainman with B. & M. R. R. on location of proposed Mt. Washington R. R.; from Dec., 1911, to Aug., 1912, rodman and instrumentman on relocation and resurvey of N. Y., N. H. & H. R. R.; during July, 1914, transitman with Hugh Nawn Co.; from June to August, 1915, chainman with B. & M. R. R., on revaluation work. Refers to R. E. Barrett, A. E. Burton, G. L. Hosmer, J. W. Howard, H. B. Luther and C. M. Spofford.

SAVAGE, JOHN DANA, Ashby, Mass. (Age 29, b. Newmarket, N. H.) Graduate of Mechanic Arts High School, Boston, 1903, and student at Dartmouth College, 1904-1905. From 1905 to 1907, rodman and transitman with Met. Park Comm., Boston; from 1907 to 1908, with Royal Securities Corp'n of Canada, as assistant engineer on street railway construction in Camaguey, Cuba; from 1908 to 1911, assistant engineer with Porto Rico Railway, Light and Power Co.; from 1911 to 1914 with Porto Rico Const. Co. of San Juan, as assistant engineer on hydro-electric development; from 1914 to 1915, assistant engineer on water-works construction at Mansfield, Mass.; is now resident engineer on construction of Ashby Reservoir for city of Fitchburg, Mass. Refers to P. M. Blake, G. H. Fernald, D. A. Hartwell, W. F. Learned, C. W. Sherman and P. W. Taylor.

SHORROCK, JOHN WILLIAM, Dorchester, Mass. (Age 23, b. Jamaica Plain, Mass.) Graduate of Tufts College Engineering School, 1915. From June, 1914, to Sept., 1915, rodman for Bay State St. Railway Co., Maintenance of Way Dept.; from April to July, 1915, assistant cement tester for Boston Transit Comm.; from July to Aug., 1915, tracer for Lockwood, Greene

& Co.; from August, 1915, to date, rodman, Maintenance of Way Dept., N. Y., N. H. & H. R. R. Refers to S. L. Conner, H. C. DeLong, F. B. Sanborn, R. C. Smith and P. B. Walker.

TAYLOR, CHARLES NORTON, Wellesley, Mass. (Age 46, b. Hampden, Me.) Received degree of B.C.E. from Maine State College, 1891, and that of C.E. from Univ. of Maine, 1898. Was for two years with engineering department, city of Newton; has been in private practice for twenty years, chiefly along line of design and construction of water and sewerage systems. Refers to E. M. Blake, H. S. French, F. L. Fuller, C. H. Gannett, X. H. Good-nough and L. D. Thorpe.

TISDALE, ELLIS SPENCE, Needham, Mass. (Age 24, b. Dorchester, Mass.) Graduate of Mass. Inst. of Technology, 1915, sanitary engineering course. During summer of 1914, and for three months during 1915, with U. S. Geological Survey, as topographic aid; is now assistant in Civil Engrg. Dept., Mass. Inst. of Technology. Refers to C. F. Allen, C. B. Breed, A. E. Burton, Dwight Porter, C. M. Spofford and G. C. Whipple.

UPHAM, ALBERT LEWIS, Woonsocket, R. I. (Age 27, b. Dorchester, Mass.) Graduate of Mechanic Arts High School, 1905. From June, 1906, to Nov., 1907, rodman, instrumentman and computer with C. F. Whitney, C.E., Boston; from Nov., 1907, to May, 1912, rodman, instrumentman and concrete inspector with B. & A. R. R.; from May, 1912, to March, 1913, transitman with C., M. & St. P. Ry.; from May to Nov., 1913, assistant engineer on wash boring and sounding tests with Port Comm. of Seattle, Wash.; from May, 1914, to January, 1915, resident engineer with Mass. Highway Comm.; from March to June, 1915, levelman on valuation work with B. & A. R. R.; is now inspector on street paving with city engineer of Woonsocket, R. I. Refers to R. F. Bessey, A. M. Lovis, F. H. Mills and A. P. Rice.

LIST OF MEMBERS.

ADDITIONS.

ALLARDICE, JAMES P.....	180 Stetson St., Fall River, Mass.
BENNETT, RAYMOND F.....	211 Commercial St., Portland, Me.
CANNON, MADISON M.,	
Care H. P. Converse & Co.,	88 Broad St., Boston, Mass.
CONNOLLY, GREGORY P.....	Beverly Farms, Mass.
DENLEY, ALFRED N.....	403 Main St., Winchester, Mass.
EVERETT, FREDERIC E.....	56 Beacon St., Concord, N. H.
HARRINGTON, WALTER.....	12 Newbury St., Boston, Mass.
MAKEPEACE, BERTRAND L.....	387 Washington St., Boston, Mass.
O'CONNOR, JAMES H.....	52 Bradfield Ave., Roslindale, Mass.

CHANGES IN ADDRESS.

ALLEN, JOHN E.....	8 Beacon St., Boston, Mass.
BIGELOW, WILLIAM W.....	Technology Chambers, Boston, Mass.

PROCEEDINGS.

7*

BOWERS, GEORGE W.....	3200 Franklin Ave., Cleveland, Ohio
BURNES, GEORGE R.....	2 Vinal St., Revere, Mass.
CARTER, FRANK H.....	13 Western Ave., Cliftondale, Mass.
DASHPER, FREDERICK C.,	
"Cremyll," Nettleham Road, Lincoln, Lincolnshire, England.	
EICHORN, FREDERICK C. H.....	306 South St., Jamaica Plain, Mass.
FREED, CHARLES.....	1111 Blue Hill Ave., Dorchester, Mass.
FULLER, PHILIP E.....	64 Adams St., Tufts College, Mass.
GALLENE, VICTOR J.....	21 Everett St., Charlestown, Mass.
GLADDING, RAYMOND D.....	Gladding Place, Fall River, Mass.
GUINEY, JOHN A.....	67 East Brookline St., Boston, Mass.
MOORE, LEWIS E.....	270 Mill St., Newtonville, Mass.
MORRILL, FRANK P.....	31 Mellen St., Cambridge, Mass.
MORRILL, FRED W.....	24 Harris St., Waltham, Mass.
OXNARD, HORACE W....	Care Chief Engr., A. T. & S. F. Ry., Topeka, Kan.
ROURKE, LOUIS K.....	6 Beacon St., Boston, Mass.
SAVILLE, THORNDIKE.....	5 Sumner Rd., Cambridge, Mass.
STEARNS, RALPH H.....	661 Westminster St., Providence, R. I.
SUMNER, MERTON R.....	22 Codman St., Portland, Me.
WHITNEY, WALTER C.....	58 Judkins St., Newtonville, Mass.
WOODBURY, STANLEY W.....	15 Sixth Ave., Haverhill, Mass.

EMPLOYMENT BUREAU.

THE Board of Government maintains an employment bureau for the Society, to be a medium for securing positions for its members and applicants for membership, and also for furnishing employees to members and others desiring men capable of filling responsible positions.

At the Society room two lists are kept on file, one of *positions available* and the other of *men available*, giving in each case detailed information in relation thereto.

MEN AVAILABLE.

331. Age 32. Received technical education from I. C. S. courses. Has had seven years' experience as rodman, transitman and chief of party for civil engineer; has also had some experience with B. & M. R. R. on maintenance of way and relocating work in New Hampshire, Vermont, etc., and with Bay State St. Ry. Co. on underground construction. Will accept position in any line of engineering work. Salary desired, \$25 per week.

332. Age 22. Student for two and one-half years at Mass. Inst. of Technology, including course at summer surveying camp. Has had about five months' experience, chiefly as rodman; has done some work as transitman

and some drafting and office work; junior member of B. S. C. E. Desires position as transitman, leveler or on plane table work. Salary desired, \$12 per week.

333. Age 27. Student at Franklin Union, civil engineering course. Has had two years' experience with Mass. Highway Commission. Desires position as rodman, timekeeper or tracer. Salary desired, \$12 to \$14 per week.

334. Age 25. Student at Harvard College for one year and at evening school for four years. Has had six years' experience as rodman, transitman and chief of party on construction work; inspector of concreting; rod-setting, pile driving, etc., on subway work; and as draftsman on studies for Boston Tunnel. Desires position as draftsman, transitman or inspector. Salary desired, \$23 per week.

335. Age 21. Has completed three years of civil engineering course at Mass. Inst. of Technology, including two months at summer surveying camp. Has had about six months' experience as estimator and as timekeeper on construction work. Desires position as rodman, instrumentman or assistant superintendent on construction work. Salary desired, \$18 per week.

336. Age 29. Has had ten and one-half years' experience; has worked as rodman, transitman, chief of party, foreman, etc.; experience includes one year on hydrographic work. Desires position as surveyor, inspector or foreman. Salary desired, \$25 per week.

LIBRARY NOTES.

RECENT ADDITIONS TO THE LIBRARY.

U. S. Government Reports.

Abstracts of Current Decisions on Mines and Mining, December, 1913, to April, 1915. J. W. Thompson.

Analysis of Natural Gas and Illuminating Gas by Fractional Distillation at Low Temperatures and Pressures. G. A. Burrell, F. M. Seibert and I. W. Robertson.

Application of Theory of Least Squares to Adjustment of Triangulation. Oscar S. Adams.

Bibliography of Chemistry of Gas Manufacture. W. F. Rittman and M. C. Whitaker.

Binders for Coal Briquets. James E. Mills.

Coke-oven Accidents in United States during Calendar Years 1913 and 1914. Albert H. Fay, Ed.

Composition of Natural Gas Used in Twenty-five Cities. G. A. Burrell and G. G. Oberfell.

Explosibility of Coal Dust. George S. Rice.

Houses for Mining Towns. Joseph H. White.

Inflammability of Mixtures of Gasoline Vapor and Air.
G. A. Burrell and H. T. Boyd.

Metallurgical Smoke. Charles H. Fulton.

Metal-mine Accidents in United States during Calendar
Year 1913. Albert H. Fay, Ed.

Methods of Preventing and Limiting Explosions in Coal
Mines. George S. Rice and L. M. Jones.

Mining and Milling of Lead and Zinc Ores in Wisconsin
District, Wisconsin. Clarence A. Wright.

Monazite, Thorium and Mesothorium. Karl L. Kithil.

Notes on Miners' Carbide Lamps. James W. Paul.

Permissible Explosives Tested Prior to March 1, 1915.
Spencer P. Howell.

Prevention of Accidents from Explosives in Metal Mining.
Edwin Higgins.

Primer on Explosives for Coal Miners. Charles E. Mun-
roe and Clarence Hall.

Primer on Explosives for Metal Miners and Quarrymen.
Charles E. Munroe and Clarence Hall.

Radium-uranium Ratio in Carnotites. S. C. Lind and
C. F. Whittemore.

Rules and Regulations for Metal Mines. W. R. Ingalls
and others.

Safety in Stone Quarrying. Oliver Bowles.

Saving Fuel in Heating a House. L. P. Breckenridge and
S. B. Flagg.

Smelting of Copper Ores in Electric Furnace. Dorsey
A. Lyon and Robert M. Keeney.

Southern Cypress. Wilbur R. Mattoon.

Strength Tests of Structural Timbers Treated by Commer-
cial Wood-Preserving Processes. H. S. Betts and J. A. Newlin.

United States Government Specification for Portland
Cement.

What a Miner Can Do to Prevent Explosions of Gas and
of Coal Dust. George S. Rice.

State Reports.

Connecticut. Biennial Reports of Highway Commissioner for 1899-1900, 1903-08, 1913-14.

Massachusetts. Problems of Port Development. Edward F. McSweeney.

Municipal Reports.

Boston, Mass. Annual Report of Public Works Department for 1913.

Chicago, Ill. Annual Report of Department of Public Works for 1914.

Fall River, Mass. Report of Watuppa Ponds and Quequechan River Commission, together with Report of Fay, Spofford and Thorndike, Consulting Engineers, 1915.

Newton, Mass. Annual Report of City Engineer for 1914.

Philadelphia, Pa. Plain Talk: Report of Department of Public Works, 1914.

Providence, R. I. Annual Report of City Engineer for 1914.

St. Louis, Mo. Annual Report of Water Commissioner for 1914.

Miscellaneous.

American Society for Testing Materials: Year-Book for 1915.

American Society of Civil Engineers: Transactions, Vol. LXXVIII, 1915.

Canada, Department of Mines: Electro-plating with Cobalt. Herbert T. Kalmus and others.

Elements of Highway Engineering. Arthur H. Blanchard. Gift of John Wiley & Sons.

LIBRARY COMMITTEE.

NEW ENGINEERING WORK.

(Under this head a brief description of new engineering work contemplated or under construction will be presented each month. Engineers and contractors are requested to send descriptions of their work to the Secretary, 715 Tremont Temple, Boston, before 1st of each month.)

United States Government.—NAVY YARD.—Work is in progress on a supply ship.

Commonwealth of Massachusetts.—METROPOLITAN WATER AND SEWERAGE BOARD.—*Water Works.*

Pipe Lines.—About 60 per cent. of the work of laying 14 370 lin. ft. of 60-in. cast-iron pipe in Commonwealth Ave., between Prince St. and the Charles River, in Newton, has been completed. The contractors are Andrew M. Cusack, of Boston, and Charles A. Kelley, of Somerville.

Surface Water Drains.—Work is in progress for laying surface water drains near Spot Pond, Stoneham. The work consists of laying 1 720 lin. ft. of 15-in. vitrified clay pipe, 450 lin. ft. of 12-in. vitrified clay pipe and a paved open channel for about 330 lin. ft. Thomas Russo & Company, of Boston, are the contractors.

Bellevue Reservoir.—The work on the granite masonry tower, which is to enclose the new steel tank (100 ft. in diameter by 44 ft. high) on Bellevue Hill, West Roxbury, is almost completed and the steel work for the roof is in place. John Cashman & Sons Company, of Boston, are the contractors.

METROPOLITAN WATER AND SEWERAGE BOARDS.—*Sewerage Works.*—Work is in progress on Sections 105 and 106 of the Wellesley Extension Sewer and on the temporary outfall for the Deer Island outfall extension.

Plans and specifications for the reconstruction of the Malden River siphon are ready.

METROPOLITAN PARK COMMISSION. — *Charles River Reservation.*—Plans and specifications have been prepared, and it is expected to call for bids in the near future for bridge over the Charles River at North Beacon St., Boston and Watertown.

Plans and specifications are being prepared for bridge over the Charles River at Commonwealth Ave., between Newton and Weston.

Work of excavating channel of Charles River from Elm St. to Bleachery Dam, Waltham, is in progress. John R. Burke, contractor.

Furnace Brook Parkway. — Work of construction of parkway extension from Quincy Shore Reservation to Hancock St. is in progress. John Cashman & Sons Co., contractors.

Work of building reinforced concrete girder bridge across Blacks Creek, for Furnace Brook Parkway Extension, is in progress. Hugh Nawn Contracting Co., contractors.

Mystic Valley Parkway. — Work of excavating the channel of Aberjona River from Boston & Maine Railroad Bridge to Waterfield St., Winchester, is in progress. Coleman Brothers, contractors.

Revere Beach Reservation. — Work of constructing concrete shore protection from Bath House Shelter to Revere Street Shelter is in progress. Coleman Brothers, contractors.

DIRECTORS OF THE PORT OF BOSTON. — *Dry Dock.* — The contract for the construction of the dry dock at South Boston awarded by the Port Directors to the Holbrook, Cabot & Rollins Corporation, of Boston, was approved by the Governor and Council on October 13, 1915, and work began immediately.

The construction of the bulkhead and filling of flats adjacent to the dry dock site was completed under previous contracts. The Commonwealth thereby has reclaimed twenty-six acres of flats, and with the completion of the filling back of the dock walls, an additional area of nine acres, making a total of thirty-five acres, will ultimately be available for the necessary repair plants and industries in connection with the commercial use of the dock.

The dry dock when completed will be the largest in the world, having a length of 1 200 ft. and entrance width of 133 ft., and capable of docking the largest ships afloat or projected for many years to come. The dock will rest on bed rock and will be constructed of concrete with a lining of granite.

Plans and specifications are now being prepared for the dry dock pumping plant.

East Boston. — The legislature on March 31, 1915, approved the new harbor lines established by the Directors of the Port of Boston for both East and South Boston, and the U. S. War Department granted its approval on August 10, 1915. These lines are now the basis for further activity in harbor improvements.

Through the establishment of these harbor lines, there is provided an immense area of flats, upwards of 800 acres, which may be reclaimed by the use of such dredged material as may be dredged from Boston Harbor, its rivers and estuaries, either by the state or by private parties.

As a first step in inaugurating this policy of conservation, there has been secured from the Secretary of War permission to close from navigation the old channel northwest of Governor's Island and to dump in that channel, and adjacent territory enclosed within the revised harbor lines, such material as the Directors or other parties may dredge from different parts of the harbor. Since June, 1915, a total of about 300 000 cu. yds. has been dumped there.

A further step is now being taken by the preparation of contracts under which there will be dredged and rehandled over one and a half million cubic yards of material from certain areas adjacent to the present anchorage basin in East Boston and deposited upon the flats of East Boston to reclaim approximately 35 acres adjacent to Jeffries Point. The areas to be dredged are so located that they will ultimately be the docks between piers which may be required for the terminals as outlined on the comprehensive plan of development for the port of Boston.

Dredging. — The Directors have during the past six months made improvements in various minor channels of the harbor by the awards of six contracts aggregating approximately 200-000 cu. yds. of material, a part of which has been dumped at East Boston within the revised harbor lines.

Traffic Investigation. — A study is in progress to determine the quantity and-routing of freight moving from the north to the south side of Boston, originating and terminating within

a certain zone surrounding Boston, extending as far as Lowell, Framingham, Walpole, Taunton and Plymouth.

The Port Directors have secured the coöperation of the three railroads, namely, the Boston & Maine, Boston & Albany, and New York, New Haven & Hartford, and they are submitting data regarding the amount of freight interchanged between these several roads. It is hoped that valuable conclusions will be drawn from this study relative to the traffic conditions about Boston.

Boston Transit Commission.—Notes on the status of the work on the Dorchester Tunnel and the East Boston Tunnel Extension were printed in the October issue of the JOURNAL.

City of Boston. — PUBLIC WORKS DEPARTMENT, HIGHWAY DIVISION, PAVING SERVICE. — Work is in progress on the following streets:

Augustus Ave.,	Poplar St. to beyond Clarendon Ave.	Bituminous macadam.
Birch St.,	Penfield St. to Dudley Ave.	Bitulithic pavement.
Bayswater St.,	Saratoga St. to Austin Ave.	Artificial stone sidewalks.
Crandall St.,	Augustus Ave. to Hillside Ave.	Bituminous macadam.
Cushing Ave.,	Windermere Rd. to Jerome St.	Artificial stone sidewalks.
Dane St.,	Holbrook St. to Orchard St.	Asphalt pavement.
Day St.,	Minden St. to Centre St.	Artificial stone sidewalks.
Elgin St.,	Centre St. to W. Rox. Branch R. R.	Asphalt pavement.
Haslet St.,	Amherst St. to Metcalf St.	Bituminous macadam.
Kenney St.,	Day St. to 500 ft. northwesterly.	Asphalt pavement.
Mackin St.,	Waverly St. to Western Ave.	Bitulithic pavement.
Oakland St.,	River St. to Rockdale St.	Bituminous macadam.
Prince St.,	Pond St. to the Arborway.	Asphalt pavement.
Public Alleys 809-10-11,	Batavia St. to Gainsborough St.	Hassam block.
Schiller Rd.,	Rockland St. to the Dedham line.	Bituminous macadam.
Spring St.,	At hospital.	Concrete fence.
Chapin Ave.,	Mt. Vernon St. to Preston Rd.	Bituminous macadam.

The Fore River Shipbuilding Co., Quincy, Mass., has the following work in progress:

U. S. Torpedo Boat Destroyers *Tucker*, Nos. 63 and 64.

U. S. Submarine Boat *Schley*.

Ten submarine boats for British Navy.

Submarine boat for Spanish government.

Two oil-tank steamers for the Texas Oil Co., *Texas* and *New York*.

Two molasses boats for Cuba Distilling Co., *Cubadist* and *Meleiro*.

Two tank steamers for the Texas Steamship Co.

The Panama Canal may consider this thing a joke, but we wish it would stop its skidding.—*Boston Transcript*.

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PAPERS AND DISCUSSIONS

This Society is not responsible for any statement made or opinion expressed in its publications

THE ARROWROCK DAM.

BY CHAS. H. PAUL,* M. AM. SOC. C. E.

At the time that the construction of the Boise (Idaho) Project of the United States Reclamation Service was undertaken, irrigation development in the Boise River Valley had proceeded to the extent that all the low water flow of the river had been appropriated. As the low water period occurred during the irrigation season, this meant that storage works became an essential feature of the Boise Project from its inception.

Extensive investigations were made to select the most favorable site for a storage reservoir. The combination of suitable dam and reservoir site was difficult to find, and it finally developed that for the best solution of the problem, and full development, a dam at Arrowrock, higher than any that had ever been built, would be required.

The construction of this dam, which was started in 1911, has been finished, and it was in service during the irrigation season of 1915, while the last stages of the work were being completed.

NOTE. — This paper is an elaboration of a talk on the same subject given by Mr. Paul before the Society on January 7, 1914, before the dam was completed.

Discussion is invited, to be received by Edward C. Sherman, Editor, 6 Beacon Street, Boston, before January 10, 1916, for publication in a subsequent number of the JOURNAL.

* Construction Engineer, Arrowrock Dam, U. S. Reclamation Service.

DESCRIPTION.

The Arrowrock Dam is located on the Boise River, twenty-two miles above the city of Boise, Ida. The maximum height of the dam is 348.6 ft., its length is 1 100 ft., it contains 585 200 cu. yds. of concrete and it has a gravity section but is built on a curve of 660 ft. radius. The lowest point of its foundation is 90 ft. below the river bed. There are 20 outlets through the dam, each 4 ft. 4 in. in diameter, and each controlled by a 58-in. balanced needle valve set on the upstream face. These outlets are arranged in two sets of ten each, the upper set being about 110 ft. below the top of the dam and the other set about 90 ft. lower. There are also, just at the old river level, five sluicing outlets 5 ft. in diameter, each controlled by a sliding gate. All gates are operated from chambers within the dam. Inspection galleries, of which the control chambers form a part, give access to the interior of the dam at several different elevations.

The spillway has a capacity of 40 000 sec.-ft. The weir is 400 ft. long and extends back upstream from one end of the dam at about a right angle to a tangent to the curve at that point. A discharge trench picks up the water along the toe of the weir and carries it past the end of the dam to the canyon of a creek that enters the river a few hundred feet below the dam. This spillway trench was excavated through solid rock, and is lined with concrete having a minimum thickness of 24 ins. and reinforced with $3\frac{3}{4}$ -in. bars, on 12-in. centers both ways. In the trench lining and the weir are 25 400 cu. yds. of concrete, making the total concrete in the dam and spillway 610 600 cu. yds.

The total excavation for dam and spillway amounted to 682 000 cu. yds.

PRELIMINARY WORK.

Preliminary to the construction of the dam, a standard gage railroad 17 miles long was built from Barberton, the end of a railroad spur out of Boise, to the dam site. Regular train service over this line has been maintained since its completion in November, 1911, and during the four years it has hauled about 80 000 passengers and nearly 15 000 000 ton miles of freight.

There was a fairly good power site at the diversion dam at the head of the main canal, about 14 miles below Arrowrock, and as coal is expensive, and of poor quality for storing, it was decided to build a hydro-electric power plant, and to use electrically driven equipment for the construction plant so far as practicable. This power plant has a maximum capacity of 3 000 h.p. Duplicate transmission lines were built from the plant to Arrowrock, and no interruptions of service worth



FIG. 1. ARROWROCK DAM — EXCAVATION.
(Looking downstream.)

Showing diversion tunnel, upper cofferdam (partly completed), main cableways, drag line excavator and steam shovel outfit.

mentioning have occurred since the power plant was put in operation in May, 1912.

The Arrowrock Dam is located at a sharp bend in the river channel, and a tunnel 500 ft. long carried the river past the work during the construction period. (Fig. 1.) The capacity of this tunnel was at least 30 000 sec.-ft. Earth filled, timber-

crib cofferdams turned the river into the tunnel and protected the work below river level from back water. This tunnel was filled with concrete for a length of about 200 ft., which came within the dam section, after it had served its purpose.

A modern construction camp, with water supply, sewerage system, general store, hospital, bathhouse, laundry, clubhouse and other features to make it complete, sanitary and attractive, was erected at a convenient location just below the dam site. As there was no town nearer than Boise, this camp had to provide for the comfort and amusement of the men and also the families of many of them who had put up shacks of their own in the immediate vicinity of camp.

SANITARY PRECAUTIONS.

At once, the problem of sanitary protection became of vital importance. It was comparatively simple to care for the main camp, which was under the absolute control of the Reclamation Service, but when little settlements began to spring up here and there, as more and more of the men brought their families to the job, the problem became more complex. Fortunately, public sentiment was all in favor of enforcing the necessary regulations. These covered the location, proper construction and disinfection of toilets, disposal of garbage, protection of water supply and the fighting of flies. The camp physician was given the duties of chief sanitary officer, and under his direction the camp foreman and his crew of janitors and camp men looked after the main camp. To aid in the proper enforcement of the necessary regulations outside of the main camp, it was arranged to look after the necessary work like disinfection, garbage collection, the furnishing of garbage cans, fly traps, etc., at a certain fixed charge for the service performed, and nearly all of the persons living outside of the main camp were glad to take advantage of this arrangement.

All applicants for employment were given a brief physical examination by the resident physician, which was made more thorough if deemed advisable. In this way the unfit or undesirable were eliminated. Vaccination for smallpox or anti-typhoid inoculation was given at the hospital without charge.

Air-tight metal garbage cans were provided, and were kept in serviceable condition. Garbage and refuse were collected every day or two, hauled away and burned. No breeding places for flies were allowed to exist. Fly traps were used constantly. All toilets and buildings where flies would be attracted were screened and provided with special screened entrances. Sleeping quarters were scrubbed, aired and disinfected frequently. Iron springs and mattresses were provided, and these were taken out and cleaned periodically. The cost of this work was not high, but the results were most satisfactory, as the general health of the community has always been away above average: there have been no epidemics of any kind and only one case of typhoid, which probably originated outside of camp.

CONSTRUCTION.

The construction of the dam was authorized in January, 1911. Immediately the preliminary work was started and work on final designs was begun. In the spring of 1912 the railroad, power plant, camp and diversion works had been practically finished. Excavation in the river bed was started in February, 1912.

Excavation for Dam Foundation.

The depth to bedrock for the foundation of the dam was from 70 to 90 ft. below the river bed. The width of the canyon at the river bed is about 200 ft., and the thickness of the dam at the bottom is 240 ft. The estimated amount of excavation in the river bed was 230 000 cu. yds. On account of the amount and depth of this excavation, the uncertainty as to the amount of pumping that would be required and the possibility of a flood that might cause trouble during the high water period in the river, it was decided not to open up all of the excavation at once, but to excavate for, and build first, a section of the dam along the upstream face, extending entirely across the canyon, with a maximum height of about 100 ft., which would bring its top well above high water, and with a cross-section heavy enough to stand by gravity. After this first section was built, the re-

mainder of the river bed excavation was taken out and the whole dam completed to the elevation of the top of the first section.

The material in the river bed was largely gravel and sand with 5 per cent. to 10 per cent. of bowlders, all of which was good material for concrete; but along one side the material was principally large granite bowlders mixed in with dirty material not fit for use. This was moved by a steam shovel, loaded into dump cars and wasted along the river bank, above and below



FIG. 2. ARROWROCK DAM — EXCAVATION.
(Looking downstream.)

Showing drag line excavator and steam shovel outfit. Loaded skips being picked up by cableways.

the dam site (Figs. 1 and 2). The rest of the material was taken out by cableways, screened and stored for use in concrete. Two cableways were erected so as to cover this work to good advantage. A drag line excavator, working in the pit between the lines of these two cableways, loaded the material into skips which were then lifted and conveyed by the cableways to a large

hopper at one side of the river, under which was located the screening and crushing plant. Two stiff-leg derricks, located at one side of the river on the edge of a steep cliff, commanded a portion of the excavation that could not be reached conveniently by the drag line. Orange-peel buckets, operated from these derricks, were used in excavating the pump sumps and cleaning up the corners. Cableways and derricks were operated by electric motors. Pumps and motors were mounted on a truck, and were let down the slope of the excavation by hand crabs.

After the first section of dam was built, the upstream cableway was moved to another position further downstream, and the remainder of the river bed excavation was handled in the same way as that for the first section.

On the south side of the river at the dam site, there is a lava bench, overlying the granite, the line of contact at the face of the cliff being about 20 to 25 ft. above river level. This lava rock varies in thickness from about 50 ft. at the edge of the cliff to about 20 ft. against the hillside. The width of the bench is about 200 ft. This lava rock was not suitable for foundation, and about 50 000 cu. yds. of it had to be removed. It was handled by skip, drag line and cableway, the drag line being used on a revolving derrick for spotting and skips. As much of the rock as was suitable was used as plums in the concrete. The remainder was taken away by cableway and dumped into the river below the dam, serving as backfilling against the downstream face below river level.

The work of cleaning up abutments, cutting key ways, etc., was done with a small crew, just ahead of the concreting, without the use of explosives except in very light shots.

Concrete.

Material for concrete was obtained from the river bed excavation, until that was used up, and later from a pit about 13 miles below Arrowrock, just off the line of the railroad. The material was screened to three sizes, sand, gravel (to $2\frac{1}{2}$ in.), and cobbles ($2\frac{1}{2}$ to $5\frac{1}{2}$ in.). The oversize passed to crushers and then back to the screens. A set of bins over each mixer held

about four hours' supply of material. Sand cement composed of 55 per cent. Portland cement and 45 per cent. pulverized granite, reground to pass 90 per cent. through the 200-mesh sieve, was manufactured on the ground. Ample bin storage was provided at the sand cement plant, and all sand cement, before being used, was tested for soundness and tensile strength, using the approved standards for Portland cement. Of the 586 500 barrels manufactured in connection with this work,

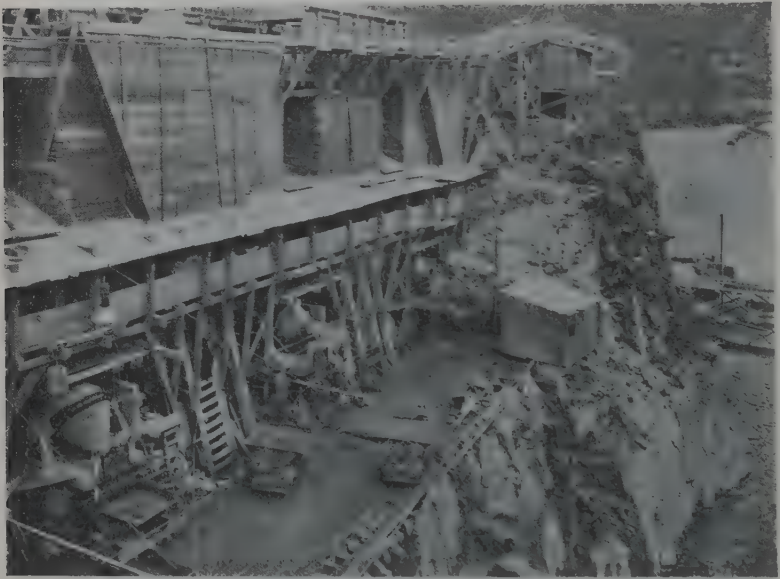


FIG. 3. ARROWROCK DAM — CONCRETE PLANT.

Showing storage bins, mixers and rocker dump, electric trolley cars, transporting concrete to distributing tower.

there has not been a failure of any of the sand cement to pass these standard tests. The sand cement was transported from its storage bins to bins over the mixers through 3-in. pipe lines by means of compressed air.

The concrete was mixed, 1 part sand cement, $2\frac{1}{2}$ parts sand, 5 parts gravel and $2\frac{3}{4}$ parts cobbles, with such temporary modifications as conditions demanded. In the toe of the dam and

for a thickness of about 10 ft. against each face, a richer mix, about $1 : 2\frac{1}{2} : 4\frac{1}{2} : 2\frac{1}{2}$, was used. This "face mix" was obtained usually by adding a sack of Portland cement to the regular mix.

The sand, gravel and cobbles from their respective bins were fed by gravity to the mixers, through adjustable measuring boxes controlled by gates operated by compressed air. These materials were measured by volume; but the sand cement was weighed out, on account of the inaccuracy of volume measurement for material of such extreme fineness. The cement bin gate was operated by hand, and through it the sand cement was fed into a tight metal box with hinged bottom, hung on steel-yards. On signal from the mixer man, all materials were dumped into the mixer almost simultaneously. Water was added at the mixer. There were three 1-cu. yd. mixers in the plant, driven by electric motors, each mixer with its measuring boxes and bins forming an independent unit (Fig. 3).

Below each mixer was a hopper with a capacity of one batch. The carriers for the mixed concrete, which will be described later, each had a capacity of two batches (2 cu. yds.).

The concrete was distributed by cableways — not the main cableways that were used for the excavation and general work, but smaller ones assembled from equipment already on the job or made up at the shops. Their span was from about 500 to 700 ft. For the work below river level, they were stretched between the steep cliffs on either side, and picked up the concrete direct from the hoppers below the mixer. Later, a high tower was erected near the center of the dam which served as a common tail tower and loading point for the three cableways, two running north and one south from this tower (Fig. 4), and the concrete was carried from the hoppers below the mixers to the foot of this tower by 2 cu. yd., rocker dump, electric trolley cars (Fig. 3).

The cableway bucket, after being loaded, was hoisted and taken out to a hopper, hung from another carriage on the same cableway, into which hopper the bucket discharged its load under the control of the cableway operator. From the bottom of the hopper was hung a chute, 40 ft. long, the free end of which was suspended from auxiliary cables and could be swung at will

to any point within a circle of 40 ft. radius. The position of the hopper, along the cableway, was controlled from the head tower, and it could be moved from point to point with no loss of time between batches.

This method was used until the work was carried to within about 50 ft. of the top of the dam, after which the main cableways took the concrete to distributing hoppers at either end of the dam, and the electric dump cars, running on a trestle just



FIG. 4. ARROWROCK DAM — CONCRETE WORK.
(Looking downstream.)

Showing tower for concrete distributing cableways, method of handling work and forming contraction joints, trash rack structures (on upstream face) for outlet gates. Portion of camp in distance. Top of dam will be 50 ft. higher than top of tower.

above the work, distributed the concrete from these hoppers.

In placing the concrete, the most scrupulous care was taken to see that the bedrock, or the old concrete surface, was thoroughly clean and free from loose particles. The process of cleaning left the surfaces thoroughly wet. Then a neat cement

grout, mixed fairly thin was slushed over the surface just ahead of the concrete, and scrubbed in with steel brooms. On bed rock, and whenever necessary on old concrete, a batch or two of mortar preceded the regular run of concrete.

Concrete was mixed of plastic consistency. The proper slope of the chutes was between 20 and 25 degrees from the horizontal. Concrete of plastic consistency would move on this slope freely, but without separation of material, and an excess of water was neither necessary nor desirable.

Grouting Foundation.

The foundation of the dam was granite, of excellent quality. The rock was free from evidence of faulting, crushing or shearing, but was characterized by rather frequent parallel joints, giving the rock a sheeted structure which has a north and south (across canyon) trend, and a high dip upstream. On account of the unusual height of the dam it was decided to grout the foundation and abutments at the heel, although it was thought that the seams would take very little grout.

The grout holes were drilled from the bottom of the keyway along the heel of the dam. Most of them were 25 to 30 ft. deep. Two rows of holes were drilled, 5 ft. and 13 ft. deep, respectively, inside the line of the upstream face of the dam. The longitudinal distance between the holes in each row was ten feet, with the holes in the two rows staggered. At the beginning of the work, these holes were drilled with Burleigh drills before the rock was covered with concrete, and were brought up through the concrete by means of 3-in. pipe to the elevation from which they were grouted. Later, after the foundation had been covered and the grouting operations were carried on up the abutments, pipes were set in place at the proper locations, and the holes were drilled, through these pipes, with a diamond drill after a sufficient depth of concrete had been placed around them. The pipes were set in such a way that the grout could flow freely into any seam that might exist between the concrete and the rock.

A line of holes which were left open for drainage was drilled just downstream from the grout holes, and were brought up through the concrete to the floor of the inspection gallery.

Straight sand cement was used for the grouting. It was mixed in the proportions of about 1 part sand cement to 5 parts water, except in a few cases when it was thickened up to about 1 to 3. Pressure for the leakage test and for final application on the grout was obtained from a tank set at an elevation of about 20 ft. above full reservoir.

Before making the leakage test, immediately prior to grouting, each hole was carefully washed out and sounded. As was



FIG. 5. ARROWROCK DAM.

(Looking upstream.)

Showing water coming through two of the lower outlets. The upper outlets are in plain sight and two of the sluicing outlets may be seen indistinctly, just above water surface

The spillway is at the left beyond the limit of the picture.

expected, most of the holes showed practically no leakage before grouting, but in a few cases an appreciable amount of leakage was detected, and some grout was forced into the rock, although no one hole took any large amount. Generally speaking, however,

the rock took enough grout so that it seemed as if the grouting operations were worth while.

The discharge through the drainage system gave the best evidence of the efficacy of the grouting operations. With water in the reservoir standing within 28 ft. of the top of the dam, or 200 ft. above the lower inspection gallery, the flow through the drainage system was so small as to be negligible.

MEMOIR OF DECEASED MEMBER.

DEXTER BRACKETT.*

DEXTER BRACKETT, past president of the Boston Society of Civil Engineers, died on August 26, 1915.



Mr. Brackett was born on November 30, 1851, in Newton, Mass. He was the only son of Cephas Henry and Louisa Thwing (Pierce) Brackett. His parents removed to Brighton while he

* Memoir prepared by Frederic P. Stearns and Charles W. Sherman.

was yet a child, and Mr. Brackett's education was obtained in the schools of that town. He was graduated from the Brighton High School in 1868, and thereafter took a course at a business college in Boston.

Up to this time he had formed no definite plan as to his future work, but in March, 1869, was offered employment in the office of the city engineer of Boston. The annexation of several adjoining towns and cities to the city of Boston, between 1868 and 1874, resulted in a large amount of work for the engineering department, particularly in the extension of the water works to the annexed districts. Mr. Brackett was soon assigned to the work connected with these extensions and to the re-arrangement and reinforcement of the main pipe systems of the city following the great fire of 1872.

Soon after the election of Mr. Joseph P. Davis (honorary member of this Society) as city engineer, in 1873, Mr. Brackett was placed in charge of the engineering work connected with the distribution system of the water works. The question of water waste was soon recognized as of great importance, and as early as 1878 Mr. Brackett, under the direction of Mr. Davis, began a careful study of that problem. Domestic water meters were then expensive and comparatively unsatisfactory, so that the first steps toward the restriction of waste were made by means of inspection, aided by the use of Deacon meters. By these means a very considerable reduction was made in the consumption of water in certain districts of the city. As a result of these studies and investigations, and of others which succeeded them, Mr. Brackett became especially interested in matters relating to the consumption and waste of water, and an authority on these subjects. He presented a paper on these subjects to the New England Water Works Association in 1886, and to the American Society of Civil Engineers in 1895.

In 1895, the State Board of Health of Massachusetts, which was then engaged in the preparation of a plan for the water supply to the Metropolitan District, asked Mr. Brackett to report to it upon the consumption of water in the district at that time and the probable future consumption.

Mr. Brackett's connection with the Boston Water Works was

continuous until 1895. During a portion of this time he was superintendent of the eastern division of the Boston Water Works, reporting to the Boston Water Board, and during the remainder of his service, assistant engineer in the city engineer's department, having particularly to do with the work relating to the water works.

Upon the formation of the Metropolitan Water Works, in 1895, Mr. Brackett was selected as engineer of the distribution department, having charge of the piping system, pumping stations and distribution reservoirs for the Metropolitan Water District.

In 1907, upon the resignation of Mr. Frederic P. Stearns, Mr. Brackett was chosen as chief engineer of the Metropolitan Water Works, which position he held to the time of his death. The greater part of the water works had been constructed prior to 1907, so that in this position Mr. Brackett had to do mainly with maintenance and operation. During his term of service, the general introduction of water meters within the Metropolitan District has been undertaken, largely as a result of his persistent advocacy of their use, and they have accomplished the result which Mr. Brackett predicted for them. In addition to the work of maintenance, however, important additions to the works were made or designed during his service as chief engineer, among which may be particularly mentioned the hydro-electric plant at the Wachusett Dam in Clinton; the 40-million gallon high-service pumping engine at Chestnut Hill; the 60-in. cast-iron pipe line from Weston to Chestnut Hill Reservoir, including the pressure tunnel through a hill in Newton; the improvement of the water supply for the elevated districts in Boston, Hyde Park and Milton, including the pumping station at Hyde Park and the steel tank on Bellevue Hill, 100 feet in diameter and 45 feet high, surrounded by a masonry tower; and the hydro-electric plant at the Sudbury Dam in Southboro, now in process of construction.

In addition to his work for the city of Boston, Mr. Brackett was employed in a consulting capacity in connection with water supplies at Fall River, Stoughton, Taunton, New Bedford, Ashburnham and Springfield, Mass.; Auburn, Me.; Syracuse,

N. Y.; Atlantic City, N. J.; Louisville, Ky.; Springfield, Mo.; Harbor Springs, Mich., and various other places, in several cases in connection with the testing of pumping engines or the valuation of the works. After 1895, however, he declined any further engagements outside of his regular work, as the latter made such demands upon his time and strength that it seemed impracticable for him to carry anything additional.

Mr. Brackett's term of service with the Boston and Metropolitan Water Works covered forty-six years, during most of which time he occupied positions of great responsibility. Since the work of the Metropolitan Water Board was in large measure a continuation of that of the old Boston Water Works, it is fair to consider Mr. Brackett's professional life as having been spent in one employ, — a decidedly unusual record, — and the value of the public service which he rendered in this period was certainly very great.

Mr. Brackett took an active interest in the technical societies to which he belonged. He joined the Boston Society of Civil Engineers on June 8, 1874, and was its vice-president in 1895-1897, and its president in 1897-1898. He took a prominent part in the New England Water Works Association, and was its president in 1889-1890. He was a director of the American Society of Civil Engineers in 1908-1910, and a member of the American Water Works Association and of the Boston City Club.

Mr. Brackett had a large circle of firm friends, both inside and outside of the profession.

He was married, in 1875, to Miss Josephine Dame who, with one son, survives him.

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

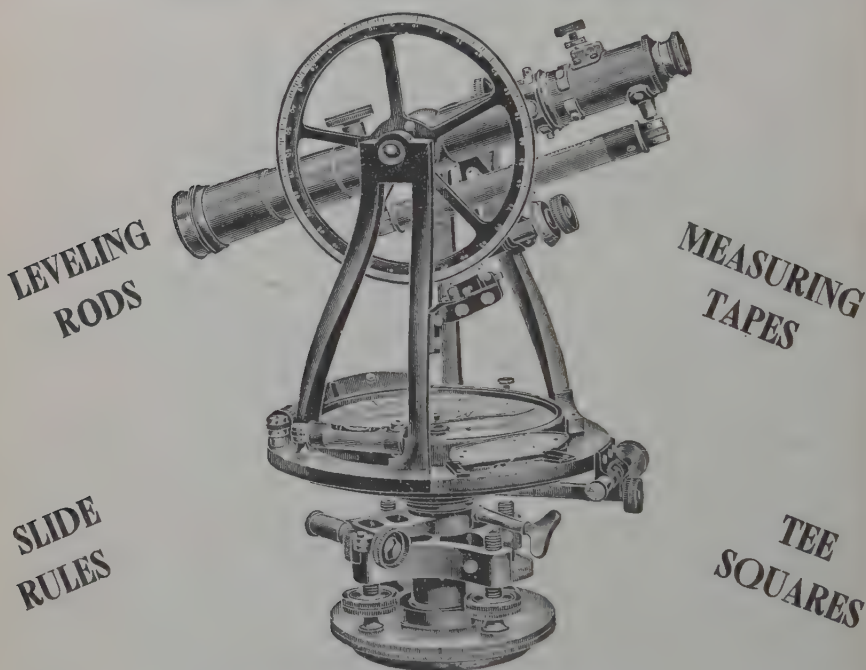
INDEX TO ADVERTISERS.

	PAGE
A. B. SEE ELECTRIC ELEVATORS, 111 Devonshire St., Boston.....	XVIII
ABERTHAW CONSTRUCTION Co., 8 Beacon St., Boston.....	XV
ADAMS, H. S., 108 Ames Building, Boston, Mass.....	IV
AMBURSEN COMPANY, 61 Broadway, New York.....	XVII
ASPINWALL & LINCOLN, 3 Hamilton Pl., Boston.....	IV
ASSOCIATED ARCHITECTS PRINTING & SUPPLY Co., 144 Congress St., Boston.....	XVII
ASSOCIATION OF ENGINEERING SOCIETIES, 3817 Olive St., St. Louis..	XVI
BAY STATE DREDGING Co., LTD., 247 Atlantic Ave., Boston.....	X
BISHOP, J. W., & Co., 683 Atlantic Ave., Boston.....	XI
BLAIR, ISAAC, & Co., INC., 433 Harrison Ave., Boston.....	XI
BOND, HAROLD L. Co., 383 Atlantic Ave., Boston.....	XVI
BRADBURY, ROYALL D., 68 Devonshire St., Boston.....	IV
BUSS, EDWARD A., 85 Water St., Boston.....	IV
CONCRETE CONSTRUCTION Co., 28 School St., Boston.....	XI
DETROIT GRAPHITE Co., 94 Milk St., Boston.....	XVII
EASTERN BRIDGE AND STRUCTURAL Co., Worcester.....	XVIII
FAY, SPOFFORD & THORNDIKE, 308 Boylston St., Boston.....	IV
FORT HILL PRESS, 176 High St., Boston.....	XVIII
FULLER, ANDREW D., Co., 3 Hamilton Pl., Boston.....	XII
FULLER, GEORGE W., 170 Broadway, New York.....	IV
GOW, THE CHARLES R., Co., 166 Devonshire St., Boston.....	XIII
HALL, JOHN G., & Co., 114 State St., Boston.....	XVII
HARRINGTON, EPHRAIM, 20 Pemberton Sq., Boston.....	IV
HERN, J. L., ENGINEERING Co., 149 Pearl St., Boston.....	IV
HERSEY MFG. Co., South Boston.....	XX
HOLBROOK, CABOT & ROLLINS, CORPN., 6 Beacon St., Boston.....	VII
HOLZER, U., 25 Bromfield St., Boston.....	X
HUGHES, EDWARD F., 8 Oliver St., Boston.....	XVII
JACKSON, D. C. & Wm. B., 248 Boylston St., Boston.....	IV
JONSBURG, F. F., Co., 733 Old South Building, Boston.....	XI
LEDGER & PROBST, 56 Franklin St., Boston.....	XVI
MAIN, CHARLES T., 201 Devonshire St., Boston.....	V
MAKEPEACE, B. L., 12 Bromfield St., Boston.....	II
METCALF & EDDY, 14 Beacon St., Boston.....	IV
MILLER, WILLIAM L., 71 Alford St., Boston.....	VIII
MOSS, CHARLES E. Co., 38 Broad St., Boston.....	XVI
NEW ENGLAND BUREAU OF TESTS, INC., 12 Pearl St., Boston.....	V
NEW ENGLAND SAND & GRAVEL Co., West Peabody, Mass.....	VIII
OLD CORNER BOOK STORE, 27 Bromfield St., Boston.....	XVII

SURVEYING INSTRUMENTS

FOR SALE, FOR RENT, REPAIRED

Second Hand Instruments Bought and Sold



Importer of and Dealer in

DRAWING MATERIALS and INSTRUMENTS

A full line of

DRAWING ROOM FURNITURE

BLACK LINE and BLUE PRINTS

B. L. MAKEPEACE

387 WASHINGTON ST. BOSTON, MASS.

Automobile and Messenger Service to all parts of the city

Please mention the Journal when writing to Advertisers

	PAGE
PALMER, JOHN E., 1012 Old South Bldg., Boston.....	XVII
PENNSYLVANIA CEMENT Co., 166 Devonshire St., Boston.....	XI
PERRIN, SEAMANS & Co., 57 Oliver St., Boston.....	XVII
RIDEOUT, CHANDLER & JOYCE, 178 High St., Boston.....	XVI
ROCKPORT GRANITE Co., Rockport, Mass.....	VI
ROURKE & SHERMAN, 6 Beacon St., Boston.....	IV
SIMPSON BROS. CORPN., 166 Devonshire St., Boston.....	VI
SMITH, B. F., & Co., 60 Federal St., Boston.....	XV
SPAULDING PRINT PAPER Co., 44 Federal St., Boston.....	XIII
STONE & WEBSTER, 147 Milk St., Boston.....	IX
THOMPSON, SANFORD E., 141 Milk St., Boston.....	IV
THOMSON METER Co., 100 Bridge St., New York.....	XV
THORPE, LEWIS D., 201 Devonshire St., Boston.....	V
TUCKER, EDWARD A., Co., 683 Atlantic Ave., Boston.....	VI
WALDO BROTHERS, Boston.....	X
WARREN BROTHERS Co., 59 Temple Place, Boston.....	XIV
WARREN FOUNDRY AND MACHINE Co., 111 Broadway, New York..	VIII
WESTON, ROBERT SPURR, 14 Beacon St., Boston.....	V
WHEELER, CHARLES D., 65 Kilby St., Boston.....	XIII
WHITMAN & HOWARD, 220 Devonshire St., Boston.....	V
WOOD, R. D., & Co., Philadelphia.....	VIII
WORCESTER, J. R., & Co., 79 Milk St., Boston.....	V

PROFESSIONAL CARDS

CHAS. T. MAIN

ENGINEER

201 Devonshire Street, Boston, Mass.

Rooms 817-833

Plans and Specifications for the erection and equip-
ment or reorganization of textile mills and other
industrial plants, including steam and
water-power plants

H. S. ADAMS**Consulting Engineer****108-9 AMES BUILDING
BOSTON, MASS.****EPHRAIM HARRINGTON****M. Am. Soc. C. E.****Consulting and Advisory Engineer**EXAMINATIONS, ESTIMATES AND REPORTS.
Private and Municipal Improvements and Developments.
PRELIMINARY SURVEYS, DESIGNS AND SUPERVISION.**20 Pemberton Sq.****Boston****ASPINWALL & LINCOLN****Civil Engineers****3 HAMILTON PLACE
BOSTON****J. L. HERN ENGINEERING CO.****Consulting Mechanical
Engineering**Heating, Ventilating and Mechanical
EquipmentTel. Fort Hill { 3013 149 PEARL STREET
4974 BOSTON, MASS.**ROYALL D. BRADBURY****Assoc. M. Am. Soc. C. E.****CONSULTING ENGINEER****Structural Steel, Reinforced Concrete**Designs, Specifications and Estimates. Review and
Approval of Plans. Inspection and Supervision of
Construction. Examinations and Investigations.
Valuations and Appraisals.**68 Devonshire St., BOSTON****D. C. & WM. B. JACKSON****Consulting Engineers**FOR ELECTRIC AND
ALLIED PROPERTIES**CHICAGO****Harris Trust Bldg.****BOSTON****248 Boylston St.****EDWARD A. BUSS****Mill Architect and Consulting
Engineer**New Construction, Rearrangements, Elec-
trical Equipment, Economy of Operation**85 Water St., Boston, Mass.****METCALF & EDDY****Leonard Metcalf****Charles W. Sherman****Almon L. Fales****Harrison P. Eddy****Wm. T. Barnes****14 Beacon Street
Boston, Mass.****Harris Trust Building
Chicago, Ill.****Water Supply and Sewerage****FAY, SPOFFORD & THORNDIKE****Consulting Engineers**BRIDGES AND OTHER STRUCTURES OF
STEEL AND MASONRY. FOUNDATIONS.
RIVER AND HARBOR WORKS**FREDERIC H. FAY CHARLES M. SPOFFORD
STURGIS H. THORNDIKE****308 Boylston Street, Boston, Mass.****ROURKE & SHERMAN****Consulting Engineers****LOUIS K. ROURKE****EDWARD C. SHERMAN**

Members Am. Soc. C. E.

Organization. Design and supervision of public
works. Railroad work. Spanish-American projects.**6 Beacon St., Boston****Tel., Hay. 855****Cable Address, "Roman," Boston****GEORGE W. FULLER****M. Am. Soc. C. E.****M. Am. Inst. Cons. E.****Consulting Hydraulic Engineer and Sanitary Expert****JAMES R. MCCLINTOCK**Water Supply and Purification, Sewerage and
Drainage, Disposal of Sewage and Refuse.
Investigation of Epidemics, Public Utilities
Valuations, Supervision of Construction and
Operation.**170 Broadway, New York, N. Y.****SANFORD E. THOMPSON****M. Am. Soc. C. E.****M. Am. Soc. M. E.****Consulting Engineer**Design of Steel and Reinforced Concrete;
Review of Plans; Estimates and Appraisals;
Tests of Cement and Concrete; Organization of
Construction and Industrial Work.**NEWTON HIGHLANDS
MASS.****141 MILK ST.
BOSTON**

LEWIS D. THORPE
Civil and Sanitary Engineer

Water Works, Sewerage and Sewage
 Disposal
 Supervision of Construction and Operation
 201 Devonshire Street
 BOSTON, MASS.

J. R. Worcester E. E. Pettee G. H. Brazer
 MEMBERS OF AM. SOC. C. E.

J. R. WORCESTER & CO.

**Consulting and Designing
 Engineers**

Bridges Foundations
 Steel and Reinforced Concrete Construction
 79 MILK STREET, BOSTON
 Cement Testing Laboratory at Waltham, Mass.

ROBERT SPURR WESTON

Laboratory for the Analysis of Water,
 Sewage, Filtering Materials, etc., Design,
 Inspection and Supervision of Water Purifi-
 cation and Sewage Disposal Plants.

14 BEACON STREET, BOSTON

WHITMAN & HOWARD

Civil Engineers

(Established in 1869)

220 Devonshire Street Room 504
 BOSTON

**NEW ENGLAND
 BUREAU OF TESTS, Inc.**

**Inspecting Engineers
 and Chemists**

Herbert L. Sherman, President
 Joshua L. Miner, First Vice-President
 A. B. Bellows, Second Vice-President
 Wm. F. Zimmermann, Secretary

Tests and inspection of Iron and
 Steel, Cement and Concrete Materials,
 Road Materials, Pipe, Wire and Machin-
 ery of all kinds.

Chemical Analyses and Research.

Our own laboratories and inspectors
 at all important points.

12 Pearl Street
 BOSTON

'Phone, Fort Hill 3038

SIMPSON BROS. CORPORATION



ENGINEERS AND CONTRACTORS FOR REINFORCED CONCRETE CONSTRUCTION

ROCK ASPHALT FLOORS — GRANOLITHIC FLOORS.
SIDEWALKS, CURBING, STEPS, BUTTRESSES, ETC.
SIMBROCO CONCRETE STONE BUILDING TRIM.
HASSAM CONCRETE STREET PAVEMENT.

ROCKPORT GRANITE

*permanently resists all
action of Sea Water*

It is an undeniable fact that chemical changes take place in the cement of CONCRETE construction exposed for any number of years to sea water, changes that are certainly not for the better.

No changes take place in Rockport Granite. It is permanent, and it is impermeable; and these FACTS are beyond question. The same facts apply to masonry work of every description — Rockport Granite is the ONE material of PERMANENCY.

A combination of Quality and Low Price is offered in Rockport Granite, full details of which will be supplied upon request. Write.

ROCKPORT GRANITE CO. - Rockport, Mass.

C. HARRY ROGERS, Treas. and Gen'l Mgr.

BRANCHES :

New York, 21 Park Row, Represented by F.E. Foster. Chicago, Chamber of Commerce Bldg., Represented by J. D. Duffy. Boston, 31 State St. Winnipeg, Canada, N. J. Dinnen Co.

EDWARD A. TUCKER COMPANY

Concrete Engineers

*Designs and Estimates Submitted Structural Steel
Concrete Reinforcement Fabrication and Erection*

ESSEX BUILDING - 683 ATLANTIC AVENUE, BOSTON
Opp. South Station

Direct Mill Connections

Warehouse, Cambridge

Shop, Camden, N. J.

Telephone, Oxford 4670

Please mention the Journal when writing to Advertisers

Holbrook, Cabot & Rollins Corp'n

Contractors

Heavy Masonry and Concrete Construction, Deep Foundations

6 BEACON STREET BOSTON, MASS.

**Charles Building, 331 Madison Avenue
New York, N. Y.**

JAMES W. ROLLINS, President
FREDERICK HOLBROOK, Vice-Pres., and Gen'l Manager
THOMAS B. BRYSON, Second Vice-President
WILLIAM S. PATTEN, Treasurer



**SHOWING EXCAVATOR
PICKING UP ITS LOAD OF
TWO CUBIC YARDS**

Send for booklet describing
the most modern method of
handling, washing and grad-
ing sand and gravel for con-
crete work, roofing and
road building

NEW ENGLAND SAND & GRAVEL CO.
WEST PEABODY, MASS.

'Phone, Peabody 244-M

WILLIAM L. MILLER

71 ALFORD STREET

CHARLESTOWN, MASS.

**Bridge, Docks, Sea Walls, Heavy Timber
and Concrete Construction**

General Contractor

TELEPHONE, 497 CHARLESTOWN

WARREN FOUNDRY AND MACHINE CO.

111 Broadway, New York City

MANUFACTURERS OF

Cast Iron Gas and Water Pipe

ALSO ALL KINDS OF FLANGE PIPE AND SPECIAL CASTINGS

**R. D. Wood & Company,
Philadelphia, Pa.**

Engineers Iron Founders Machinists

Pumping Engines, Centrifugal Pumping Machinery, Gas Pro-
ducer Power Plants (and big installations) Gas Holders, Cast
Iron Pipe, Valves and Hydrants, Water and Gas Works Ap-
pliances.

Please mention the Journal when writing to Advertisers



STONE & WEBSTER

Established 1889

OUR ORGANIZATIONS ARE PREPARED TO

FINANCE public utility developments.

BUY AND SELL securities of public utility corporations.

DESIGN steam power stations, hydro-electric developments, transmission lines, city and interurban railways, gas plants, industrial plants and buildings.

CONSTRUCT either from our own designs or from designs of other engineers or architects.

REPORT on public utility properties, proposed extensions or new projects.

MANAGE railway, light, power and gas companies.

Stone & Webster Securities Department
Stone & Webster Engineering Corporation
Stone & Webster Construction Company
Stone & Webster Expert Department
Stone & Webster Management Association

NEW YORK

BOSTON

CHICAGO

Bay State Dredging Co.
 LTD.
 247 Atlantic Ave. Boston



**River and Harbor Improvements
 Dock Dredging a Specialty**

GORHAM H. WHITNEY, Pres. and Mgr. JAMES E. GASHMAN, Treasurer.

WALDO BROTHERS

BOSTON, MASS.



NEW ENGLAND AGENTS FOR
 ATLAS PORTLAND CEMENT
 AKRON SEWER PIPE

U. HOLZER, BOOK-BINDER

25 BROMFIELD ST., BOSTON, MASS.

ESTABLISHED 1870.

All kinds of Books bound and repaired.

Maps and Charts mounted.

Portfolios, Scrap Books, Blank Books, etc., made to order.

Lettering in Gold; Paper-Splitting; Inlaying; etc.

Photographs Mounted on Card or Paper without Cockling.

Telephone
 and
 Elevator

Please mention the Journal when writing to Advertisers

F. F. JONSBURG CO.

Engineering Construction

Switch Cell Construction

733 OLD SOUTH BUILDING
BOSTON

THE EXTREME HIGH QUALITY OF PENNSYLVANIA PORTLAND CEMENT

MAKES ITS USE ESSENTIAL WHERE
WORK OF THE HIGHEST CLASS IS DESIRED

PENNSYLVANIA CEMENT CO.

NEW YORK OFFICE
30 East 42d St.

BOSTON OFFICE
166 Devonshire St.

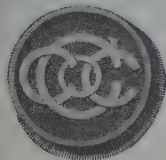
NEW YORK
53 FIFTH AVENUE

BOSTON
683 ATLANTIC AVENUE

J. W. BISHOP COMPANY GENERAL CONTRACTORS

PROVIDENCE
617 BUTLER EXCHANGE

WORCESTER
109 FOSTER STREET



THE
Concrete Construction Co.
28 SCHOOL STREET
BOSTON

CONCRETE
Foundations, Roads, Walks
Floors and Cellars

WATERPROOFING
EXCAVATING
AND
GRADING

GEO. A. BLAIR

L. L. STREET

W. O. WELLINGTON

ISAAC BLAIR & CO., Inc., General Contractors

Shoring and Moving Buildings a Specialty

433 Harrison Avenue, BOSTON

Please mention the Journal when writing to Advertisers



ESTATE IN CONCORD, MASS.

T. MOTT SHAW, ARCHITECT

ANDREW D. FULLER CO.**Constructors
Engineers****3 HAMILTON PLACE, BOSTON***Country Estates Complete*

Please mention the Journal when writing to Advertisers

THE CHARLES R. GOW COMPANY

Contractors for Engineering Construction

No. 166 DEVONSHIRE STREET

BOSTON, MASS.

CHARLES D. WHEELER
Insurance

Telephone 5231 Main

65 KILBY STREET, BOSTON

*Liability, Fire, Life, Accident, Marine
and Automobile Insurance*

**ALSO CONTRACTORS' BONDS AT LOWEST RATES
CONSISTENT WITH ABSOLUTE SECURITY**

Spaulding Print Paper Co.
BLUE PRINTERS

Blue Prints made from profile and other long tracings in continuous lengths. Small or large orders furnished in the quickest possible time.

A full line of DRAWING MATERIALS in stock at lowest Prices

44 FEDERAL STREET, BOSTON, MASS.

TELEPHONE, MAIN 4103 or 1390

Please mention the Journal when writing to Advertisers

A Standard of Excellence

in any field is decided and set by the consensus of opinion among the buyers, not the sellers.

In the Paving Field

Ask the present and former cities who have used it what they think about

BITULITHIC

The greatest care is used in the construction of the Bitulithic pavement. It renders unfailing service. Bitulithic is made of varying sizes of the best stone obtainable combined with bituminous cement and laid under close laboratory supervision. You must remember that quality should be first consideration. The condition of the streets indicates the character of the city.



BITULITHIC PAVEMENT, DARTMOUTH ST., BOSTON, MASS.

Pavement laid 1903

Photograph taken Sept., 1913

Stop and Consider

BITULITHIC, before determining to use inferior street paving. It is cheaper to have a good pavement in the beginning than to contract for cheap construction which has to be repaired every year.

NO TIME LIKE THE PRESENT

to consider what construction you are going to use on your streets. Specify BITULITHIC and have a pavement which is unrivaled in reputation — unquestioned in quality — unequaled in popularity.

Don't wait; get your contracts in early for BITULITHIC, a pavement suitable under all the varying climatic conditions.

Write to-day for explanatory booklets, and learn more about this modern pavement for modern cities.

WARREN BROTHERS COMPANY

Executive Offices : 59 Temple Place, Boston, Mass.

DISTRICT OFFICES:

NEW YORK, N. Y.
50 Church St.

CHICAGO, ILL.
10 So. LaSalle St.

ROCHESTER, N. Y.
303 Main St., West

LOS ANGELES, CAL.
926 Calif. Bldg.

PORTLAND, ORE.
Journal Bldg.

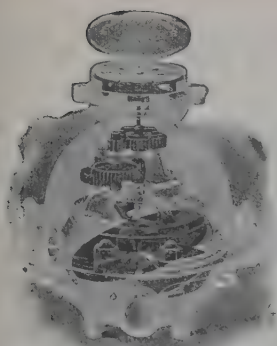
PHOENIX, ARIZONA
204 Noll Bldg.

NASHVILLE, TENN.
606 First Nat'l Bank Building

ST. LOUIS, MO.
Railway Exchange Bldg.

RICHMOND, VA.
Virginia Railway & Power Bldg.

Please mention the Journal when writing to Advertisers



"LAMBERT" METERS

Made in all sizes from five-eighths to six inch of best bronze composition. Fitted with our unbreakable "Disc" of hard rubber reinforced with a steel plate.

The "Lambert" water meter has made meter systems popular.

THOMSON METER CO.

100-110 BRIDGE STREET BROOKLYN, N. Y

**THIS SPACE
IS
FOR SALE**



"Builders-Not Bidders"

This building was erected on our regular cost-plus-profit basis — a basis of mutual confidence — of value received and satisfaction given. And the result could not but be right.

That is the way we build factories — power houses — dams — warehouses — of reinforced concrete and brick and steel.

ABERTSHAW CONSTRUCTION CO.

Contracting Engineers Specializing in Concrete

8 BEACON STREET

(6-38)

BOSTON

Please mention the Journal when writing to Advertisers

PROMPT SERVICE

GOOD QUALITY

FAIR PRICES

HAROLD L. BOND COMPANY

HAROLD L. BOND, Pres.

GEORGE S. HEDGE, Treas.

TOOLS AND MACHINERY**For All Forms of Construction Work**Boilers, Engines, Pumps, Dump Cars, Derrick Fittings, Blocks, Rock Drills,
Dynamite, Blasting Supplies, Iron and Steel

RAILROAD, MILL AND CONTRACTORS' SUPPLIES

383-391 ATLANTIC AVENUE : : : : BOSTON

Long Distance Telephone

LEDDER & PROBST, Inc.

56 Franklin Street, Boston, Mass.

Surveying Instruments**REPAIRING****BLUE AND BLACK PRINTS****Drawing Materials****RIDEOUT, CHANDLER & JOYCE****Engineers and Piping Contractors**

178 HIGH STREET - BOSTON, MASS.

Steam Specialties, Engineers' Supplies
Piping of All Kinds Furnished or Erected**CHARLES E. MOSS CO.****Blue Printing and Blue Print Paper****Engineering and Drafting Supplies**

38 Broad Street - Boston

TEL. MAIN 3295 and 2751

C.D. Kirkpatrick, Mgr. S.P. Gates, Asst. Mgr.

B. F. SMITH & CO., INC.

ESTABLISHED 1878

**ARTESIAN AND DRIVEN WELLS
FOUNDATION BORINGS**Engineers and Contractors for Municipal and Private
Water WorksOffice: 1st NATIONAL BANK BUILDING,
60 FEDERAL STREET, BOSTON, MASS**ELIMINATION OF THE TOWER GROVE
CROSSINGS, ST. LOUIS***By S. L. Wonson***ADJUSTMENT OF THE CONSEQUENTIAL
DAMAGES AT THE TOWER
GROVE CROSSINGS***By L. R. Bowen***SUGGESTED FORM OF INVENTORY
FOR VALUATION OF COMMON
CARRIER PROPERTY***By D. F. Jurgensen***SPHERICAL BEARINGS VERSUS
FLAT PLATES IN CRUSHING
TESTS ON BRICKS***By E. L. Baker and Alex. F. Suss***Journal of the Association of Engineering
Societies, October, 1915. \$3.00 per
year. 30 cents per copy.****JOSEPH W. PETERS, Secretary
3817 Olive St. ST. LOUIS, MO.**

PERRIN, SEAMANS & CO.

Machinery, Tools and Supplies

FOR

Construction Work

57 OLIVER STREET, BOSTON

EDWARD F. HUGHES
Artesian and Driven Wells

for
Manufacturing, Public or Private
Water Supply

954 Oliver Building, 8 Oliver Street, Boston, Mass.
TEL. 1633 MAIN

Engineering Books

THE OLD CORNER BOOK STORE

Have the Largest Stock at the Lowest
Prices. Call and examine. Prompt
attention given mail orders.

27-29 BROMFIELD STREET
BOSTON, MASS.

DETROIT GRAPHITE COMPANY
PAINT MAKERS

Special Penstock and Standpipe Paint
"Superior Graphite Paint" for Steel
Bridges and Buildings

94 Milk St., Boston, Mass.

AMBURSEN COMPANY

Engineer-Constructors

Reinforced Concrete Dams and
Hydraulic Work

61 Broadway

New York City

JOHN G. HALL & CO.

114 STATE STREET, BOSTON

PILING

JOHN E. PALMER

Contracting Engineer

Contractor for Sewers, Water Works,
Concrete Bridges, Concrete
Foundations, etc.

Room 1012, Old South Building
Boston, Mass.

Telephone, Fort Hill 1731

Associated Architects Printing & Supply Co.

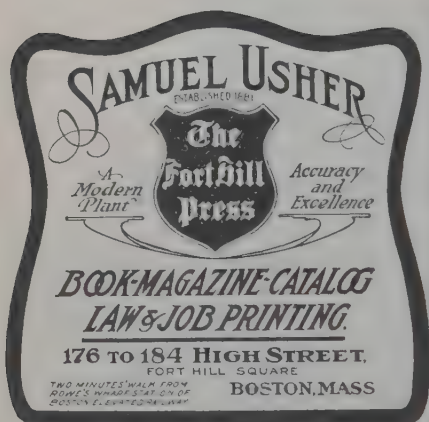
144 CONGRESS STREET, BOSTON

BLUE, BLACK AND VANDYKE PRINTING ON PAPER OR LINEN

BLACK ON WHITE REPRODUCTION PROCESS—ANY COLOR

DRAWING MATERIALS AND SUPPLIES

TELEPHONE, FORT HILL 4013



A. B. SEE ELECTRIC ELEVATORS

Of All Types

Push Button Elevators
Automatically Controlled
for Residences, Etc.

NEW YORK

HARTFORD

PHILADELPHIA

BALTIMORE

WASHINGTON

JERSEY CITY

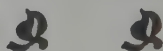
MONTREAL

BOSTON OFFICE

MINOT BUILDING

111 Devonshire St.

EASTERN BRIDGE



— AND —



STRUCTURAL CO.

Worcester, Massachusetts,

For Prices on all Classes of

STEEL AND IRON WORK.

WE DESIGN AND MANUFACTURE

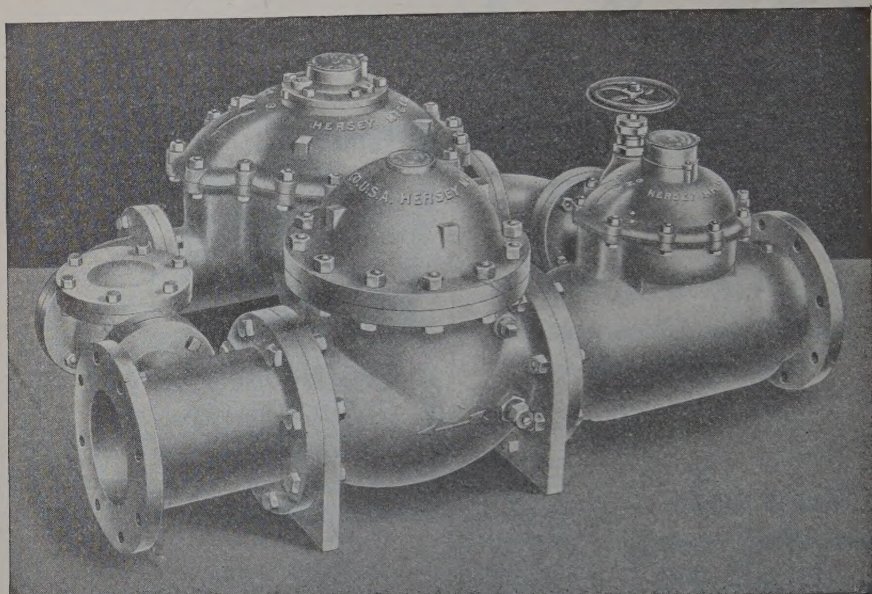
ROOF TRUSSES, GIRDERS, COLUMNS, STAIRS
AND FIRE ESCAPES FOR BUILDINGS

FOOT BRIDGES, HIGHWAY BRIDGES, RAILROAD BRIDGES

We Carry a Large Stock of
I-BEAMS, PLATES AND ANGLES

Can Make Quick Deliveries.   Send in Your Inquiries.

Please mention the Journal when writing to Advertisers



STOP WHOLESALE LOSSES

USE THE HERSEY DETECTOR METER ON FIRE SERVICES

THIS METER HAS BEEN ACCEPTED WITHOUT RESTRICTION
BY INSURANCE COMPANIES AND WATER WORKS
IN MORE THAN 500 CITIES AND TOWNS
IN THE UNITED STATES AND CANADA
FOR USE ON MORE THAN 3,000 FIRE SERVICES

Protecting nearly \$2,000,000,000 Worth of Property

HERSEY MFG. COMPANY

Main Office and Works : South Boston, Mass.

Boston	New York	Philadelphia	Chicago	Columbus, O.
Atlanta	San Francisco	Los Angeles	Portland, Ore.	

"ALL KINDS OF METERS FOR ALL KINDS OF SERVICES"

OVER 600,000 SOLD

SPECIAL COMMITTEES — Continued

ON SOCIAL ACTIVITIES

EDMUND M. BLAKE, Chairman

CHARLES H. EGLEE	LAURENCE H. MANLEY
FREDERICK C. H. EICHORN	EDWIN R. OLIN
CLARENCE T. FERNALD	DAVID S. REYNOLDS
N. LeROY HAMMOND	CHARLES W. SHERMAN
EDWIN D. HAYWARD	HENRY A. SYMONDS

ON PAPERS AND PROGRAM

LEWIS E. MOORE, Chairman

WALTER W. CLIFFORD	JOSEPH H. LIBBEY
SAMUEL L. CONNER	HOWARD B. LUTHER
ARTHUR W. DEAN	STURGIS H. THORNDIKE
JAMES B. FLAWS	GEORGE C. WHIPPLE
J. ARTHUR GARROD	HENRY B. WOOD

RATES FOR ADVERTISEMENTS

For one year — 10 issues

One page	\$75.00
One-half page	40.00
One-quarter page	25.00
One-sixth page	17.50
One-eighth page	14.00
One-twelfth page	10.00

Last page, 50 per cent. additional.

For further information, or for contract forms, address

EDWARD C. SHERMAN, Editor,
6 Beacon Street, Boston.

